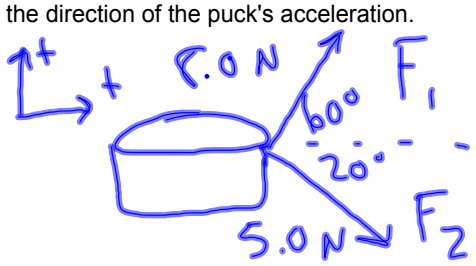
Force Practice Problems and Notes 4th Block 9.15.11

A hockey puck having a mass of 0.30 kg slides on the horizontal, frictionless surface of an ice rink. Two hockey sticks strike the puck simultaneously, each exerting a force. The first stick's force is 5.0 N at 20 degrees south of east, and the second stick's force is 8.0 N at 60 degrees north of east. Determine both the magnitude and the direction of the puck's acceleration.

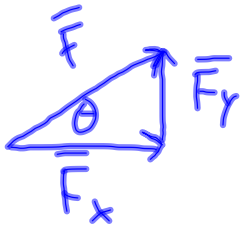


$F_{1x} = F_1 \cos(60°)$ $\quad F_{1y} = F_1 \sin(60°)$

$+F_{2x} = F_2 \cos(20°)$ $\quad +F_{2y} = F_2 \sin(20°)$

$F_x = 8.69\ N$ $\quad F_y = 5.22\ N$

$$\sum \bar{F} = m\bar{a}$$



$\bar{F} = 10.1\ N$ @ $30.9°$ N of E

$$\sum F = ma$$

$$a = \frac{\sum F}{m} = \frac{10.1\ N}{.30\ kg} = 33.8\ m/s^2$$

$\bar{a} = 33.8\ m/s^2$ @ $30.9°$ N of E

General Notes:

- Units of force are newtons (N)

$$1\ N = 1\ \frac{kg \cdot m}{s^2}$$

- Direction of the net force and acceleration are the same

- To calculate weight:

$$F_g = m a_g$$

- Another force:

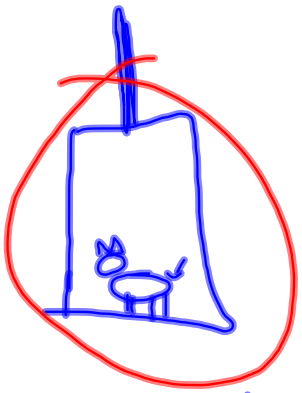
  Tension

  - happens in strings
  - strings are massless and don't stretch

- Plug in $9.8\ m/s^2$ for a_g.

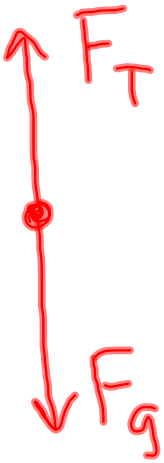
  We take care of negative sign when doing sum of forces.

A 2.00 kg cat is in a 97.00 kg elevator. What force on the elevator cable would be needed to raise the cat/elevator pair upwards with a constant velocity?



$M_{cat} = 2.00\,kg$

$M_{elev} = 97.0\,kg$



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*equilibrium prob.

$$\Sigma F_y = 0$$

$$+F_T + (-F_g) = 0$$

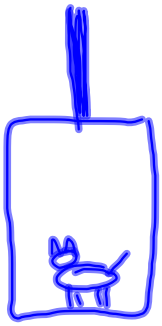
$$F_T = F_g$$

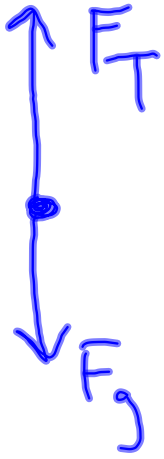
$$= m a_g$$

$$= (99\,kg)(9.8\,m/s^2)$$

$$= 970\,N$$

A 2.00 kg cat is in a 97.00 kg elevator. What force on the elevator cable would be needed to raise the cat/elevator pair upwards with an acceleration of 2.00 m/s/s upwards?





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Non-equilibrium

$$\sum F_y = m a_y$$

$a_y = +2.00\ m/s^2$

$m = 99\ kg$

$$F_T + (-F_g) = m a_y$$

$$F_T = F_g + m a_y$$

$$= m a_g + m a_y$$

$$= m(a_g + a_y)$$

$$= 1168\ N$$